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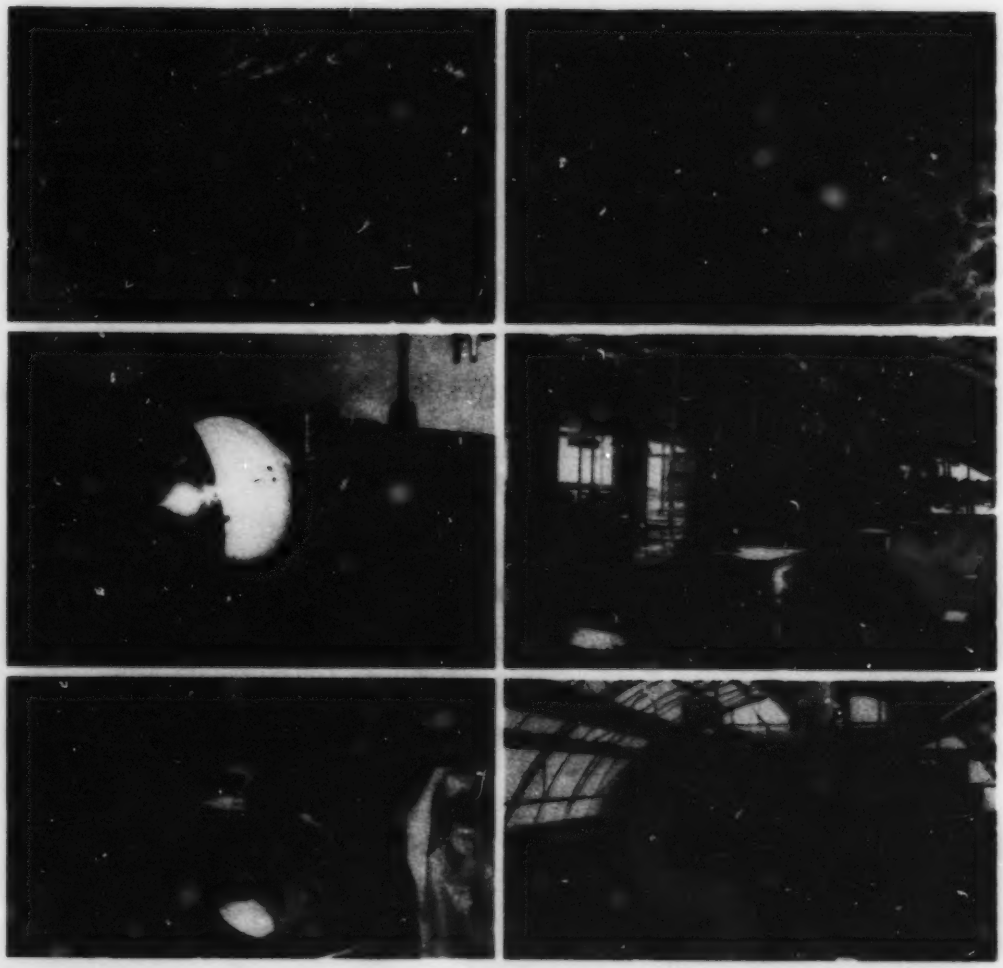
Forest Renewal Research and Development Needs Survey



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Legend to Figures on Cover

Upper left:	Maples in the Carolinian forest.
Upper right:	Stem cross-section of black spruce, fluorescence microscopy.
Middle left:	Chlorophyll fluorometer.
Middle right:	Greenhouse cubicles at the Ontario Forest Research Institute, Sault Ste. Marie.
Lower left:	Pressure chamber.
Lower right:	Spruce container stock.

Forest Renewal Research and Development Needs Survey

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ABSTRACT

The survey described in this report solicited input from major clients of the Ontario Ministry of Natural Resources Forest Renewal Group on the establishment of research priorities. Key research needs were in the areas of overwintering planting stock, assessment of physiological quality and stress levels, drought conditioning, development of non-herbicidal approaches for post-planting vegetation control, growth and yield, seed viability and germination, and comparison of stock types. Respondents also indicated a need for improved technology transfer, including continuing education of their staff and regular dissemination of research results.

ACKNOWLEDGMENTS

I thank the Stock Production/Forest Renewal Group for their input throughout the preparation and analysis of the survey. Special thanks to Colin Templeton for compiling the statistics. I am also grateful to Paul Webb and Bob Wagner for their helpful comments.

INTRODUCTION

The survey described in this report was distributed to obtain input from major clients of the Forest Renewal Group at the Ontario Forest Research Institute (OFRI) for the purpose of reviewing and planning a research and development strategy. The primary objective of the survey was to identify key research needs. A second objective was to identify ways to improve the Group's technology transfer to its clients.

The Forest Renewal Group conducts basic and applied research related to regeneration of seedlings and early field performance. The Group includes:

Steve Colombo (Stress physiology)
Tom Noland (Biochemistry/Molecular biology)
Gina Mohammed (Structure and Function)
Peter Menes (Bareroot stock production)
Kerry Odlum (Container stock production)
John Paterson (Field performance).

Of the 133 survey forms distributed, 98 were completed; respondents included 13 container and 9 bareroot nurseries, 13 Forest Management Agreement[1] (FMA) holders, and 63 Ontario Ministry of Natural Resources (OMNR) sources such as Technology Development Units, Container Specialists, District Offices, Regional Foresters, and Regional Forestry Specialists. Respondents were categorized by OMNR administrative region (Northeast, Northwest, Central, and Southern) and group (FMA holders, container/bareroot nurseries, and OMNR[2]). Regional and group influences have been identified each section. Appendices I and II contain the survey results and an analysis of regional/group influences, respectively.

[1]A major form of long-term Crown land tenure in Ontario.
[2]Excluding provincial bareroot nurseries.

The survey was sub-divided into eight sections:

A) seed viability and germination
B) production of bareroot seedlings
C) production of container seedlings
D) methods of stock quality assessment
E) factors affecting field performance
F) natural regeneration
G) additional research subjects
H) respondent comments and information transfer.

Respondents were asked to prioritize the research items in each section as follows:

0 - no need for research in this area
1 - low need for research in this area
2 - moderate need for research in this area
3 - high need for research in this area
N - no opinion.

In the analysis, the percentage of respondents who chose "2" or "3" (both were given equal weight for the purpose of the survey) was calculated for each item and was used to rank items in order of importance.

KEY RESEARCH NEEDS

Overall, the top five research needs all pertained to overwintering of container seedlings. In order of importance, these were:

1. Determine the effects of current overwintering procedures on field performance.
2. Determine conditioning needed when removing overwintered stock from freezers for planting.
3. Determine when stock is ready for frozen overwinter storage.
4. Identify factors which damage stock or affect stock quality for trees overwintered in controlled-environment storage.
5. Develop seedling overwinter hardening regimes to minimize overwinter damage and maximize seedling quality.

The top research needs in each of the eight sections were:

Seed Viability and Germination

Improve germination with respect to:
- Final percentage;
- Speed.

Production of Bareroot Seedlings

- Determine conditioning needed when removing overwintered stock from freezers for planting.
- Determine when bareroot stock is ready for frozen overwinter storage.

Production of Container Seedlings

- Determine the effects of current overwintering procedures on field performance.
- Determine conditioning needed when removing overwintered stock from freezers for planting.

Methods of Stock Quality Assessment

Evaluate and implement seedling quality tests which could be used in the nursery/field to identify:

- Stress status prior to field planting;
- Biologically safe times for lifting and cold/frozen storage.

Factors Affecting Field Performance

- Determine if and how planting stock could be conditioned against drought.
- Evaluate the importance of nutrient reserves in stock for outplanting performance.

Natural Regeneration

- Compare growth and yield of natural and planted stands.
- Identify attributes of naturally regenerating seedlings which favour successful stand establishment.

Additional Research Subjects

- Evaluate and develop non-herbicidal approaches for post-planting vegetation control.
- Identify early stand (< 5 years) indicators of long-term stand growth and yield.

Group and Regional influences were particularly evident in the sections on production of bareroot seedlings and factors affecting field performance (Appendix II).

TECHNOLOGY TRANSFER

Respondents identified a need for continuing education. A range of options and subjects was suggested. Field performance of nursery stock and weed control (including non-chemical methods) were most frequently cited as suitable workshop topics. Respondents also wanted to see summaries of research projects, perhaps presented in a format such as a newsletter. Current transfer of research reports could be improved, since half of the respondents indicated that they did not receive regular mailings from OFRI.

Scientists (both from OFRI's Forest Renewal Group and from Forestry Canada) are the major source of expertise for most respondents, followed closely by OMNR Technology Development Units. Other less frequently used sources are libraries, other OMNR personnel, and university researchers.

HOW WILL THE FOREST RENEWAL GROUP ADDRESS THESE NEEDS?

Overwintering

The Forest Renewal Group has established overwintering as one of the five main projects areas that it will be focusing upon in the next 5 years. Under the leadership of Steve Colombo, this project will seek to maximize seedling quality and minimize overwinter damage to nursery stock by manipulating hardening regimes, seedling handling practices, and overwinter storage environments. A joint proposal with Prof. E. Blumwald (Botany Department, University of Toronto) for an Ontario Renewable Resources Grant to study root frost hardiness has been approved and will commence in 1991/1992. Cooperation with most OMNR bareroot nurseries is ongoing for semi-operational testing of new conditioning regimes and techniques.

Methods of Stock Quality Assessment

The Group has recently obtained approval to launch assessment of physiological stock quality as a new project area, under OMNR's new Sustainable Forestry initiative. This is a 4- to 5-year project that involves all scientists in the Group. Its objective is to improve plantation performance through the development and application of physiological grading criteria. Existing methods of assessing seedling physiological quality, such as determination of root growth potential, will be developed for use with Ontario stock types, species and sites. New technologies, such as chlorophyll fluorescence and infrared thermography, will be studied to determine their effectiveness as measures of seedling quality and level of stress. Two additional components of this project are (1) the establishment of a Stock Testing Lab to evaluate the physiological quality of seedlings produced at nurseries throughout the province and to determine the status of stock which is now being planted; and (2) the development of a Forest Ecosystem-Based Stock Type Field Testing program, to provide stock type recommendations based on site and competition conditions.

Natural Regeneration

Natural regeneration is another new project area that the Group will be introducing under the Sustainable Forestry initiative. In this 4- to 5-year project our aim is to understand the key plant factors that influence the establishment of seedlings in natural stands over a range of site, harvesting and competition conditions. We hope to be able to identify the conditions that provide for successful natural regeneration and use this information to predict potential success in given situations. We also intend to use knowledge obtained on the structure and function of naturally regenerated seedlings to improve the quality of stock produced in nurseries.

Seed Viability and Germination

Research in this area will be spearheaded by Tom Noland, whose expertise includes the biochemical aspects of seed dormancy. His work has begun with white spruce [Picea glauca (Moench) Voss]. Gina Mohammed is also investigating the effects of pre-soaking seed on the speed and synchrony of germination in white pine.

Other Subjects

Growth and yield (e.g., early indicators of later performance), drought conditioning, the importance of nutrient reserves in field performance, non-herbicidal approaches to weed control, and other essential research needs identified in the survey will receive strong consideration in the setting of research priorities for the Renewal Group. Some research in growth and yield and drought conditioning has been carried out over the past 5 years at OFRI, and emphasis will be placed upon transfer of this information to end-users.

Technology Transfer

The Group is evaluating several options to improve our technology transfer. These include: organizing an annual seminar that would present the state of the art in Forest Renewal; preparing an annual research update or research newsletter that would encapsulate current projects and progress; and distributing research posters to OMNR field offices. We are also in the process of preparing a biographic profile of the Group, so that clients will know who to contact for specific problems. For mailings, the names and addresses of respondents who indicated that they wished to be on OFRI's mailing list have been submitted to our Institute's Technology Transfer office.

CONCLUSIONS

The results of this survey provide a valuable assessment of research priorities for the Forest Renewal Group by our clients. Overwintering, growth and yield, non-herbicidal weed control, seed viability and germination, stock type comparisons, and physiological quality assessment were all perceived as of high priority. The Renewal Group is already conducting research in some of these areas, and these will be emphasized in the future. We are also undertaking to incorporate other significant subject areas into the Group's research strategy for the coming years. Clients identified a need for improved technology transfer, primarily through stronger communications with the Renewal Group. We are now seeking to address this requirement through a more thorough distribution of scientific information and research results.

APPENDIX I

FOREST RENEWAL RESEARCH AND DEVELOPMENT NEEDS SURVEY

For each item in sections A through G, respondents circled the number that best indicated the priority they placed on the need for research on the item:

0 - No need for research in this area
1 - Low need for research in this area
2 - Moderate need for research in this area
3 - High need for research in this area
N - No opinion

Items in the following table have been ranked, where "1" denotes the highest percentage of respondents who identified a moderate or high need for research in this area.

		RANK WITHIN SECTION	RANK OVERALL
A.	*Seed Viability and Germination (6 items)*		
1.	Assess the effects of seed storage procedures on viability and germination.	5	90
2.	Determine the effects of seed size on uniformity of germination and crop growth.	4	80
3.	Improve germination with respect to:		
	i) Final percentage,	1	48
	ii) Speed,	2	72
	iii) Synchronization,	3	73
	iv) Damping off.	6	108
B.	*Production of Bareroot Seedlings (22 items)*		
4.	Determine if and how stock production is affected by compartment history.	22	100

5.	Determine optimal seeding densities.	16	77
6.	Evaluate soil management techniques (e.g., amendments, mulches) for nurseries.	14	65
7.	Identify ways to optimize irrigation.	19	91
8.	Determine relationships between seedling morphology/physiology and type/concentration/ frequency of application of fertilizer.	8	38
9.	Relate visible symptoms on seedlings to nutrient deficiencies/toxicities.	10	43
10.	Evaluate the requirements for micronutrient supplements at the nursery.	18	84
11.	Determine whether there are relationships between nursery procedures and the incidence of:		
	i) root rot,	9	40
	ii) multiple-leadering	21	99
12.	Develop growing regimes for hardwood species.	17	79
13.	Evaluate and develop options for disease prevention and control in the nursery.	7	39
14.	Evaluate and develop methods for biological control of nursery pests.	4	26
15.	Identify nursery treatments that encourage mycorrhizal development on seedlings.	13	56
16.	Evaluate the effectiveness of root wrenching, undercutting, and pruning in controlling seedling morphology and improving plantation establishment.	5	28
17.	Improve/refine the electrical impedance method of assessment for lifting stock.	11	52
18.	Determine the effects of current overwintering procedures on subsequent field performance.	6	36

19.	**Identify factors that damage stock or affect stock quality for trees overwintered in:**		
	i) Snow caches,	12	53
	ii) Nursery beds,	15	71
	iii) Heeling-in beds,	20	98
	iv) Controlled-environment storage.	3	24
20.	**Determine when bareroot stock is ready for frozen overwinter storage.**	2	17
21.	**Determine the conditioning needed when removing overwintered stock from freezers for planting.**	1	9

C. Production of Container Seedlings (22 items)

22.	**Develop guidelines for peat quality for use as a container growing medium.**	17	81
23.	**Establish optimal densities for growing stock.**	16	63
24.	**Determine the optimal seed sowing depth.**	22	111
25.	**Identify ways to optimize irrigation.**	18	95
26.	**Improve greenhouse growing regimes by evaluating environmental and cultural factors (e.g., day/night temperatures, light quality, CO_2 levels).**	12	50
27.	**Determine relationships between seedling morphology/physiology and type/concentration/frequency of application of fertilizer.**	10	29
28.	**Relate visible symptoms on seedlings to nutrient deficiencies/toxicities.**	13	51
29.	**Evaluate the requirements for micronutrient supplements in the nursery.**	19	96
30.	**Develop an operational test to assess root frost hardiness and freezing damage.**	6	11

31.	Determine the effects of current overwintering procedures on field performance.	1	1
32.	Identify factors that damage stock or affect stock quality for trees overwintered in:		
	i) Snow caches,	15	58
	ii) Controlled-environment storage,	4	6
	iii) Seedling holding areas.	7	16
33.	Develop seedling overwinter hardening regimes to minimize overwinter damage and maximize seedling quality.	5	5
34.	Determine when stock is ready for frozen overwinter storage.	3	4
35.	Determine the conditioning needed when removing overwintered stock from freezers for planting.	2	2
36.	Develop greenhouse regimes for producing containerized hardwood planting stock.	21	105
37.	Evaluate and develop options for disease prevention and control in the nursery.	11	45
38.	Evaluate and develop methods for biological control of nursery pests.	9	20
39.	Identify nursery treatments that encourage mycorrhizal development on seedlings.	14	54
40.	Assess the efficacy of new container types in altering root form and improving outplanting success.	8	19
41.	Develop new container types.	20	97
D.	*Methods of Stock Quality Assessment (7 items)*		
42.	Develop or improve stock quality grading protocols based on:		
	i) Morphology,	6	55
	ii) Physiology.	4	15

43.	Develop grading standards for hardwood stock.	7	85
44.	Evaluate and implement seedling quality tests that could be used in the nursery/field to identify:		
	i) Stock stress levels during growth,	5	34
	ii) Biologically safe times for lifting and cold/frozen storage,	2	10
	iii) Biologically safe times for outplanting,	3	12
	iv) Level of stress prior to field planting.	1	3
E.	*Factors Affecting Field Performance (42 items)*		
45.	Evaluate the importance of nutrient reserves in stock for outplanting performance.	2	13
46.	Understand the relationships between biochemical activity in planting stock and outplanting performance.	13	33
47.	Relate type and degree of post-planting stress to field survival and growth.	5	21
48.	Identify site factors (e.g., lack of water, soil temperature, soil mineral deficiencies/ toxicities, atmospheric pollutants, pesticides, disease agents) that are responsible for post-planting stress in nursery stock.	10	30
49.	Determine the structural, physiological, and biochemical bases for seedling resistance to stress.	9	27
50.	Identify the physiological characteristics of planted trees that typify successful establishment or growth check of tree seedlings in plantations.	12	32
51.	Determine means of extending the planting season without reducing field performance.	32	82

52.	Develop methods for proper timing of herbicide application to minimize crop damage while effectively treating competing vegetation.	16	42
53.	Determine the effectiveness of underplanting as a regeneration strategy for white pine.	27	70
54.	Compare field performance of the following stock types:		
	i) Bareroot stock, container stock, and greenhouse transplants;	29	75
	ii) Multiple-leadered seedlings and single-leadered seedlings;	41	109
	iii) Stock grown in different container types;	22	64
	iv) Rooted cuttings and seedlings;	36	92
	v) Other.	14	35
55.	Relate stock type to field performance in terms of:		
	i) Survival,	18	47
	ii) Growth rates,	4	18
	iii) Stress sensitivity,	8	25
	iv) Stock/site compatibility,	11	31
	v) Other.	26	69
56.	Assess and develop alternative growing regimes/ schedules to improve field performance.	15	37
57.	Determine if and how planting stock could be conditioned against the following stresses:		
	i) High light intensity,	40	112
	ii) Ultraviolet radiation,	39	107
	iii) Extreme heat,	6	22
	iv) Drought,	1	8
	v) Freezing temperatures,	28	74
	vi) Wind,	38	102
	vii) Lack of nutrients,	31	78
	viii) High salt concentrations in soil,	42	110
	ix) Competing vegetation,	3	14
	x) Insect attack,	37	94
	xi) Fungal infection,	35	89
	xii) Root rot,	33	86
	xiii) Rough handling,	34	88
	xiv) Other.	30	76

58.	**Evaluate the effects of the following stock handling steps on field performance:**		
	i) Lifting,	24	67
	ii) Packaging,	21	59
	iii) Storage,	7	23
	iv) Grading,	25	68
	v) Shipping,	23	66
	vi) Pre-planting practices (e.g., root soaking).	19	49
59.	Assess the effects of various types of site preparation (e.g., mechanical, chemical, prescribed burn) on stock survival and growth.	17	44
60.	Develop site-specific guidelines for nursery stock production and selection.	20	57

F. Natural Regeneration (5 items)

61.	Determine the effects on ecosystem diversity and stability using monoculture planting stock versus natural regeneration.	4	93
62.	Understand the effects of environmental disturbance (e.g., global warming, pollutants) on natural regeneration of commercial species.	5	106
63.	Develop harvesting techniques that will favour natural regeneration of conifers.	3	61
64.	Identify the attributes of naturally regenerating seedlings that favour successful stand establishment.	2	46
65.	Compare growth and yield of natural and planted stands.	1	41

G. Additional Research Subjects (8 items)

66.	Determine the criteria by which trees can be classified as successfully regenerated (e.g., based on free-to-grow surveys).	3	62
67.	Evaluate and develop non-herbicidal approaches for post-planting vegetation control.	1	7
68.	Identify regeneration strategies for addressing global warming concerns.	8	104
69.	Identify early (<5 years) stand indicators of long-term stand growth and yield.	2	60
70.	Evaluate and introduce alternative tree species that are resistant to local pests.	6	101
71.	Improve or develop methods for rooting cuttings.	7	103
72.	Evaluate the potential of new technologies (e.g., tissue culture) in reforestation.	4	83
73.	Evaluate and implement a computerized expert system for forest regeneration decision-making.	5	87

H. Respondent Comments and Information Transfer

74. List your prioritization of the top five research and development needs that you currently face, where "1" = Highest Priority.

(Ninety-three respondents.)

#1 = **Growth and Yield** (52%)
(identified mainly by FMA holders and OMNR personnel[3])
early stand indicators; natural vs. planted stands; stock type based.

#2 = **Weed control - general** (39%)
(identified by Southern Region, OMNR personnel, FMA holders)
timing of applications; non-chemical methods.

[3]Other than those from provincial nurseries.

#3 = Overwintering (29%)
(identified by Northeastern, Northwestern and Central Regions, and nurseries)
guidelines/procedures (cold and frozen storage); impacts of current procedures on field performance; readiness for storage.

#4 = Seed viability and germination (27%)
(identified by Northwestern and Southern regions, and nurseries)
improve germination, speed, synchronization.

#5 = Non-chemical weed control (20%)
(identified by Southern, Central and Northeastern Regions, and OMNR).

Stock type comparisons (20%)
(identified by Southern, Central and Northeastern Regions, and OMNR)
stock vs. site; Bareroot vs. Container vs. transplant.

Physiological assessment/stress status (20%)
(identified by Northeastern and Northwestern Regions, and nurseries)
develop general grading protocols; pre-planting levels of stress; stress in the nursery/field.

75. Are there other research and development needs that you consider to be important but which have not been included in our list? If yes, specify.

(Thirty-five respondents.)

There was no strong consensus: No more than two or three respondents answered in each subject area. Examples of such subjects included:

- Development of machine vision technology for grading of stock quality,
- Optimal spacing/density regimes for boreal plantings,
- Analysis of aerial seeding technologies with respect to potential seed damage and seeding precision,
- Development of inexpensive methods to determine stocking and free-to-grow status,

76. Can you identify services (e.g. educational seminars) that the Stock Production/Forest Renewal Group of OFRI might be able to provide to your nursery/unit?

(Forty respondents.)

#1 = **Continuing education** (70%):
videos, seminars, brochures, manuals for private growers, advice, site visits; in most aspects of renewal, such as weed control, seed storage/handling/biology, quality assessment, stock physiology, overwintering, natural regeneration, hardwood research, factors influencing field performance, careful logging, and setup of trials.

#2 = **Summaries of research results** (43%),
to communicate these results to the field; e.g. periodic newsletter (similar to "On Line") - monthly, quarterly, or annually. There was no consensus as to frequency.

77. Are there topics that you would like to see covered in a future workshop on forest renewal?

(Forty-five respondents.)

#1 = **Field performance** (27%) (requested mainly by Central Region):
factors affecting field performance - storage, handling, root soaking, morphological links to field performance,

#2 = **Weed control** (27%) (requested mainly by OMNR):
herbicide timing, mixing, alternative/non-chemical methods.

A variety of other subjects were also mentioned, e.g.:

- Economics of regeneration strategies,
- Hardwood research update,
- Harvesting for regeneration,
- Natural regeneration - assessment of performance,
- Quality assessments - morphological and physiological methods,
- Seed quality and seed technologies,
- Stock type vs. field performance - correlations with culture,
- Overwintering - frozen, cold, snow caches - methods.

78. Do you and/or your organization receive mailings from the Technology Transfer office of the Ontario Forest Research Institute (formerly the Ontario Tree Improvement and Forest Biomass Institute)?

(Ninety-one respondents.)

Everyone wanted to receive mailings, but 44 to 49% either do not receive any or were not sure if they were on our list.

79. If you have questions regarding technical or scientific aspects of forest renewal, who (e.g., scientists, Technology Development Unit, libraries) do you approach for assistance?

(Seventy-seven respondents.) Fifty-seven percent of the respondents use at least two sources regularly. FMA holders primarily (8 of 10 FMA holders) use the TDUs.

#1 = Scientists (55%) - equally divided between Forestry Canada and the Stock Production group at OFRI,

#2 = TDUs (52%),

#3 = Library (35%),

#4 = Other OMNR sources(31%),

#5 = Other (26%) - other companies, peers, U.S. sources, commercial forestry labs,

#6 = University faculty (19%).

APPENDIX II

REGIONAL AND GROUP INFLUENCES

Note: Items listed within each section are not in order of ranked importance. Numbers in brackets preceded by a "Q" refer to the questions in Appendix I.

Section A. Seed Viability and Germination.

Primarily nurseries and OMNR personnel were interested in most of these subjects. Damping-off was of interest mainly in the Southern Region.

Section B. Production of Bareroot Seedlings.

Regional influences:

Central Region:

- Relationships between seedling morphology/physiology and fertilization (Q.8),
- Biological control of nursery pests (Q.14).

Southern Region:

- Root rot (Q.11.i),
- Multiple-leadering (Q.11.ii),
- Growing regimes for hardwoods (Q.12),
- Disease prevention/control in the nursery (Q.13),
- Biological control of nursery pests (Q.14),
- Effectiveness of root pruning (Q.16),
- Electrical impedance (Q.17),
- Readiness for frozen overwinter storage (Q.20).

Northwestern Region:

- Biological control of nursery pests (Q.14).

Northeastern Region:

- Biological control of nursery pests (Q.14),
- Snow caches - factors that damage stock (Q.19.i),
- Conditioning required for frozen storage (Q.20).

Group influences:

OMNR and the nurseries shared similar perceptions, and were particularly interested in:

- Biological control of nursery pests (Q.14),
- Root pruning (Q.16),

- Electrical impedance (Q.17).

FMA holders rated the following areas highest:

- Mycorrhizal development on nursery stock (Q.15),
- Effects of overwintering on field performance (Q.18),
- Conditioning of freezer stock prior to removal (Q.21).

Section C. Production of Container Seedlings.

Results did not differ considerably among the groups of respondents or regions. However, FMA holders were most interested in determining the effects of overwintering procedures on field performance (Q.31) (7 of 10 respondents).

Section D. Methods of Stock Quality Assessment.

Regional influence:

The Southern Region was most interested in developing tests to identify biologically safe times for lifting and cold/frozen storage (87% of the 73 respondents). The Southern and Central Regions were more interested than other regions in developing physiological protocols for grading stock quality. However, the Central region would also like to see research on morphological grading.

Group influence:

On the whole, group influence was low, but FMA holders stood out in their relative lack of interest in developing grading standards for hardwood stock.

Section E. Factors Affecting Field Performance.

Regional influence:

The Central and Southern Regions gave high ratings to:

- Effects of site factors on post-planting stress (Q.48),
- Relationships between physiology and growth check (Q.50),
- Drought conditioning (Q.57.iv).

The Central Region also wanted:

- Analysis of the basis for stress resistance (Q.49),
- Methods for herbicide timing (Q.52),
- Field comparisons of different container types (Q.54.iii),
- Stock type related to growth in the field (Q.55.ii to iv).

The Southern Region wanted to see:

- Conditioning of stock against heat (Q.57.iii),
- Conditioning of stock against competing vegetation (Q.57.ix),
- Evaluation of storage effects (Q.58.iii).

The Northeastern Region was especially interested in:

- Heat conditioning (Q.57.iii),
- Drought conditioning (Q.57.iv),
- Conditioning against competing vegetation (Q.57.ix).

Group influence:

FMA holders were primarily interested in:

- Effect of post-planting stress (Q.47),
- Timing of herbicide application (Q.52),
- Stock type vs. growth rate (Q.55.ii),
- Drought conditioning (Q.57.iv),
- Conditioning against competing vegetation (Q.57.ix),
- Site preparation effects (Q.59).

Nurseries were mainly interested in:

- The basis for seedling resistance to stress (Q.49),
- Heat and drought conditioning (Q.57.iii and iv).

Section F. Natural Regeneration.

OMNR respondents showed the most interest in this section, particularly in:

- Harvesting for natural regeneration of conifers (Q.63),
- Identifying favourable attributes of natural regenerants (Q.64).

FMA holders wanted to see:

- Comparisons of growth and yield of natural and planted stands (Q.65).

Section G. Additional Research Subjects.

There was no strong regional influence, but the central region was particularly interested in early stand indicators of long-term performance (Q.69).

Similarly, a group influence was largely absent.